The crystals of silicotetraphenylamide are perfectly colourless short prisms of considerable size. They melt at 136—137° to a transparent liquid, which can be heated to 210° without decomposition. On cooling this liquid solidifies to a transparent glass which, like the original crystals, can be easily decomposed by water.

If silicotetraphenylamide be heated under diminished pressure (about 80 mm.), it affords a distillate of aniline, and leaves a residue which seems to be the silicon analogue of *carbodiphenylimide;* but the latter has not yet been completely analysed.

The detailed investigation of the new substance and its derivatives is in active progress, and promises to throw light on the hitherto obscure relations of silicon and nitrogen.

I have reason to believe that the homologues of aniline, and certain other analogous nitrogen compounds, act like excess of aniline on the silicon haloids, and produce substances similar to the subject of this note. These reactions are also being investigated in my laboratory.

IV. "On the Magnetisation of Iron and other Magnetic Metals in very strong Fields." By J. A. Ewing, B.Sc., F.R.S., Professor of Engineering in University College, Dundee, and William Low. Received October 29, 1888.

(Abstract.)

Early in 1887 the authors communicated to the Royal Society the results of experiments made by subjecting iron to strong magnetic force by placing the sample, in the form of a bobbin with a short narrow neck and conical ends, between the pole-pieces of an electro-magnet. The experiments have been continued and extended by using much stronger magnetic forces and by testing samples of nickel, cobalt, and various steels, as well as wrought iron and cast iron. The large magnet of the Edinburgh University Laboratory, kindly lent by Professor Tait, was used throughout the experiments, and allowed the authors to effect a high concentration of the magnetic force by using bobbins the necks of which had a cross-sectional area of (in some cases) only $\frac{1}{1500}$ of the cross-sectional area of the magnet cores. By this means the induction $\mathfrak{B}$ was raised to the following extreme values:—

In wrought iron	45,350 c.g.s.
„ cast iron	31,760 „
„ Bessemer steel	39,880 „
„ Vickers' tool steel	35,820 „
„ Hadfield's manganese steel	14,790 „
„ nickel	21,070 „
„ cobalt	30,210 „

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The induction was measured by means of a coil consisting of a single layer of very fine wire wound upon the central neck of the bobbin. Outside of this coil, at a definite distance from it, a second coil was wound, and the magnetic force was determined in the annular space between the two. In a paper communicated to the Manchester meeting of the British Association, the authors showed that if the force so measured could be proved to have the same value as the magnetic force within the metal neck itself, it would follow that the intensity of magnetism $\mathfrak{J}$ had begun to diminish under the action of excessively strong fields, in the manner which Maxwell's extension of the Weber-Ampère theory of molecular magnets anticipates. In the present paper the authors discuss at some length the question of how far the magnetic force within the metal is fairly measurable by the magnetic force in the ring of surrounding air, and they show that with the form of cones originally used the force within the metal must have been less than the force outside, by an amount probably sufficient to explain the apparent decrease of $\mathfrak{J}$. The form of cone suited to give a uniform field of force with sensibly the same value in the metal neck and round it is investigated; and experiments are described in which the condition necessary for a uniform field was satisfied. The results of these experiments are conclusive in showing that no considerable change takes place in the value of $\mathfrak{J}$ (in wrought iron) when the magnetic force is varied from about 2000 to 20000 c.g.s. units. Throughout this range of force, the intensity of magnetism has a sensibly constant value of about 1700 c.g.s. units, which is to be accepted as the saturation value for wrought iron. The term saturation may be properly applied in speaking of the intensity of magnetism, but there appears to be no limit to the degree to which the magnetic induction may be raised.

To produce the greatest concentration of force upon the central neck, the converging pole faces should have the form of cones, with a common vertex in the middle of the neck, and with a semi-vertical angle of 54° 44′. This form, however, does not give a uniform field in the neighbourhood of the vertex. To secure that, the condition is that $d^2\mathrm{F}/dx^2$, $d^2\mathrm{F}/dy^2$, and $d^2\mathrm{F}/dz^2$ shall vanish, F being the magnetic force at the vertex, which is due mainly to the free magnetism distributed over the pole faces. The condition for a uniform field is satisfied when the cones have a semi-vertical angle of 39° 14′. When this form is given to the cones, the magnetic force in the air immediately surrounding the central neck may be taken as sensibly equal to the force within the neck, and it therefore becomes practicable to measure the relation of the induction to the force producing it, that is to say, the magnetic permeability.

The greatest attainable concentration may be calculated by assuming the pole faces to be saturated, when the cones are such as to

have maximum concentrative power (semi-vertical angle $= 54° 44'$). Under these circumstances the magnetic force at the vertex due to the free magnetism on the conical faces is—

$$18{,}930 \log_{10} \frac{b}{a},$$

where b is the diameter of the poles at the base of the cones, and a the diameter of the central neck.

The following are probable values of the intensity of magnetism when saturation is reached in the particular metals examined:—

	Saturation value of $\mathfrak{J}$.
Wrought iron	1700
Cast iron	1240
Nickel (with 0·75 per cent. of iron)	515
Nickel (with 0·56 per cent. of iron)	400
Cobalt (with 1·66 per cent. of iron)	1300

Experiments were also made with specimens of Vickers' tool steel, and other crucible steels, Whitworth's fluid-compressed steel, Bessemer steel, Siemens steel, and Hadfield's manganese steel. This last material, which is noted for its extraordinary impermeability to magnetic induction, was found to have a constant permeability of about 1·4 throughout the range of forces applied to it, namely, from 2000 to nearly 10,000 c.g.s.

The results are exhibited graphically by curves drawn in Rowland's manner to show the relation of the permeability to the magnetic induction. In the highest field examined, the permeability of wrought iron had fallen to about 2.

V. "The Waves on a rotating Liquid Spheroid of finite Ellipticity." By G. H. BRYAN, B.A. Communicated by Professor G. H. DARWIN. Received November 6, 1888.

(Abstract.)

The hydrodynamical problem of finding the waves or oscillations on a gravitating mass of liquid which when undisturbed is rotating as if rigid with finite angular velocity in the form of an ellipsoid or spheroid, was first successfully attacked by M. Poincaré in 1885.

In his important memoir "Sur l'Équilibre d'une Masse fluide animée d'un Mouvement de Rotation,"* Poincaré has (§ 13) obtained the differential equations for the oscillations of rotating liquid, and

* 'Acta Mathematica,' vol. 7.